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Studies on the Effect of Biostimulants on Quality of Cut Flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The aim of this study was to investigate the effect of biostimulants on quality of cut flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White". It was carried out at naturally ventilated polyhouse at Ammapuram, village of Thorrur mandal, Mahabubabad district near JVR Horticulture Research Station, Malyal, Mahabubabad district during 2020- 2021. The treatments used were Ascophyllum nodosum (2.5, 5ml L^{-1}), Rhodophyte extract (0.2, 0.4g L^{-1}), Potassium humate (1.5, 3g L^{-1}), Fulvic acid 10% + Seaweed 8% + Spirulina 6 % (2, 4 g L^{-1}) and control (Water spray) in Randomized Block Design (RBD) with nine treatments and each treatment was replicated thrice. Among the treatments, the treatment T_2 (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum flower diameter (7.48 cm), individual flower weight (6.55 g), stem length (72.10 cm), vase life (21.60 days) and shelf life (5.84 days), gross returns (₹ 76,93,200), net returns (₹ 59,82,204) and best benefit cost ratio (3.50). However, control recorded minimum in all the parameters.

Keywords: Bio stimulants; chrysanthemum; denjigar white; RBD; Ascophyllum nodosum.

1. INTRODUCTION

"Flowers and flowering plants have been a fascinating part of our life. Chrysanthemum (*Dendranthema grandiflora*) is a most beautiful and oldest flowering plant, commercially grown in different parts of the world. Chrysanthemum occupies a prominent place in ornamental horticulture and is one of the commercially exploited flower crop, belongs to the family 'Asteraceae' and popularly known as "Queen of the East", "Autumn Queen", "Mums" and "Guldaudi". It is a leading commercial flower crop grown for cut flowers, loose flowers and pot plant. Chrysanthemum as a short day plant, naturally flowers in the autumn and winter. The flowers are suitable for various purposes like bedding plant, vase decorations, garland making and for garden display" [1].

"After green revolution, the indiscriminate use of chemical fertilizers has lead to negative impact on environment. To mitigate this, biostimulants have been emerged as a supplement to the mineral fertilizers and hold a promise to improve the yield as well as quality of the crop under protected conditions" [2]. Biostimulants are the materials other than the fertilizers that promote the plant growth when applied in minute quantities and are also referred as 'metabolic enhancers' [3]. "Plant bio-stimulant is referred as "any substance or microorganism, in the form in which it is applied to plants, seeds or the root environment with the intention to stimulate natural processes of plants benefiting nutrient use efficiency, tolerance to abiotic stress, regardless of nutrients content, or any combination of such substances or microorganisms intended for this use" [4]. The use of seaweed extract is a promising natural resource to be utilized as an alternative for increasing crop production and quality. Keeping in view, the need and importance of biostimulants, the present investigation was conducted with an objective to study the effect of biostimulants on quality of cut flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White.

2. MATERIALS AND METHODS

The present investigation was carried out during the *Rabi* season of the year 2020-2021 at Ammapuram (V), Thorrur (M), Mahabubabad district. Healthy and rooted terminal cuttings were planted on the raised beds at a spacing of 15 cm x 15 cm under polyhouse. The design adopted was Randomized Block Design with nine treatments and replicated thrice. Treatments included T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}, T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}, T_3- Rhodophyte extract @ 0.2 g L^{-1}, T_4- Rhodophyte extract @ 0.4 g L^{-1}, T_5- Potassium humate @ 1.5 g L^{-1}, T_6- Potassium humate @ 3 g L^{-1}, T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}, T_8- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 4 g L^{-1}, T_9- Control (Water spray). These biostimulants were sprayed on the foliage at 3 intervals *i.e.* @ 30, 45 and 60 days after transplanting (DAT) and the observations recorded were flower diameter, individual flower weight, stem length, vase life, shelf life and economics were recorded and the data were statistically analysed.

Schedule of spray: 30,45 and 60 days after transplanting (DAT).

3. RESULTS AND DISCUSSION

The results of the experiments have been presented in Tables 1-3.

3.1 Flower Diameter (cm)

With respect to the quality parameters in chrysanthemum, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum flower diameter (7.48 cm) (Table 1).Whereas the minimum flower diameter was recorded in T_9 - Control (Water spray) (4.48 cm). The enlargement in size of the flower might be due to production of more food which was diverted to flowering area. There by due to presence of more food reserves in the flowering parts results in maximum diameter of flowers. Hegde et al. [5] found that spray of *Ascophyllum nodosum* (Brown sea weed extract) produced maximum flower diameter in chrysanthemum and increased quality in flowers. These results are corroborated with findings of Tartil et al. [6] in pot marigold, Kahkashan et al. [7] in tuberose, Hegde et al. [8] in orchids.

3.2 Individual Flower Weight (g)

Among all the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest individual flower weight (6.55 g) (Table 1). While T_9 - Control (Water spray) recorded lowest individual flower weight (5.09 g). The increase in the individual flower weight was might be due to translocation of food reserves from vegetative parts to reproductive parts. Due to the increase of food and carbohydrate reserves in flower portion, the size of the flower increases there by, the weight of the flower increases. The results are in accordance with the findings of Kahkashan et al. (2017) in tuberose.

Table 1. Effect of biostimulants on flower diameter and individual flower weight of chrysanthemum (*Dendranthema grandiflora*) cv.denjigar white

Treatments / Biostiumlants (T)	Flower diameter (cm)	Individual flower weight (g)
T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}	6.46^a	6.08^a
T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}	7.48^a	6.55^a
T_3- Rhodophyte extract @ 0.2 g L^{-1}	4.83^b	5.14^c
T_4- Rhodophyte extract @ 0.4 g L^{-1}	5.02^b	5.19^c
T_5- Potassium humate @ 1.5 g L^{-1}	5.12^b	5.23^c
T_6- Potassium humate @ 3 g L^{-1}	5.64^b	5.74^b
T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}	5.82^b	5.87^b
T_8- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 4 g L^{-1}	6.63^a	6.39^a
T_9- Control (Water spray)	4.48^b	5.09^c
S.E. m±	0.53	0.20
CD@ 5%	1.62	0.59

Table 2. Effect of biostimulants on stem length, vase life and shelf life of chrysanthemum (*Dendranthema grandiflora*) cv.denjigar white

Treatments/biostiumlants (T)	Stem length (cm)	Vase life (days)	Shelf life (days)
T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}	69.23^a	19.59^b	4.89^b
T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}	72.10^a	21.60^a	5.84^a
T_3- Rhodophyte extract @ 0.2 g L^{-1}	64.66^c	15.56^f	3.88^c
T_4- Rhodophyte extract @ 0.4 g L^{-1}	65.49^c	16.48^e	4.16^c
T_5- Potassium humate @ 1.5 g L^{-1}	66.82^b	17.56^d	4.40^b
T_6- Potassium humate @ 3 g L^{-1}	67.90^b	18.53^c	4.56^b
T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}	68.51^b	19.27^b	4.75^b
T_8- Fulvic acid 10% + Seaweed 8% Spirulina 6% @ 4 g L^{-1}	70.39^a	20.84^a	5.31^a
T_9- Control (Water spray)	62.87^c	14.82^f	3.52^c
S.E. m±	1.06	0.39	0.26
CD@ 5%	3.19	1.17	0.78

Table 3. Effect of biostimulants on economics of chrysanthemum (*Dendranthema grandiflora*) cv. denjigar white

Treatments / Biostiumlants (T)	Concent ration (ml/g L^{-1})	Number of flower stalks ha^{-1} (Yield)	Total cost of cultivation ha^{-1} (₹)	Gross returns (₹)	Net returns (₹)	B:C ratio
T_1 -*Ascophyllum nodosum*	2.5 ml L^{-1}	17,98,500	16,65,993	71,94,160	55,28,167	3.32
T_2-*Ascophyllum nodosum*	5 ml L^{-1}	19,23,300	17,10,996	76,93,200	59,82,204	3.50
T_3 -Rhodophyte extract	0.2 g L^{-1}	13,75,950	16,52,635	55,03,800	38,51,165	2.33
T_4 -Rhodophyte extract	0.4 g L^{-1}	14,84,750	16,84,270	59,39,000	42,54,730	2.53
T_5 -Potassium humate	1.5 g L^{-1}	15,52,600	16,59,500	62,10,400	45,50,900	2.74
T_6 -Potassium humate	3 g L^{-1}	16,37,200	16,98,000	65,48,800	48,50,800	2.86
T_7 -Fulvic acid 10% + Seaweed 8% + Spirulina 6%	2 g L^{-1}	17,35,000	16,66,329	69,40,000	52,73,671	3.16
T_8 -Fulvic acid 10% + Seaweed 8% + Spirulina 6%	4 g L^{-1}	18,73,350	17,11,658	74,93,400	57,81,742	3.38
T_9 -Control (Water spray)	-	12,53,300	16,21,000	50,13,200	33,92,200	2.09

3.3 Stem Length (cm)

Irrespective of the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum stem length (72.10 cm) (Table 2). Whereas the minimum stem length was recorded in T_9 - Control (Water spray) (62.87 cm). The highest stem length was observed in sea weed extract sprayed plants as they are the precursors of auxin, cytokinin and micronutrients. The increase in the stem length might be due to the fact that, gibberellins promoted the efficacy of plants in terms of photosynthetic activity, uptake of nutrients and their translocation, better partitioning of assimilates into reproductive parts. Results are in consonance with the findings of Majeed Khadim Al-Hamzawi [9] in Chinese carnation and *Gazania splender* and Bhargavi et al. [10] in chrysanthemum.

3.4 Vase Life (days)

The data recorded on the vase life depicts that treatment T_2 (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest vase life (21.60 days) (Table 2). Whereas T_9 - Control (Water spray) recorded lowest vase life (14.82 days). "The increase in the vase life of chrysanthemum may be due to the entry of sea weed extract into the plant, might have mediated the respiration by acting as a hydrogen acceptor, thus altering the carbohydrate metabolism of plants promoting the accumulation of sugar" Cacco and Dell Agnola, [11] and also sea weed extract contain cytokinin and auxin that might have increased the antioxidant levels and resistance to senescence leading to enhanced longevity of stem. These results were supported by the findings of Hegde et al. (2016) in chrysanthemum, Tartil et al. (2016) in pot marigold, Kahkashan et al. (2017) in tuberose and Hegde et al. (2020) in orchids.

3.5 Shelf Life (days)

Among all the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum shelf life (5.84 days) (Table 2). While the minimum shelf life was recorded in T_9 – Control (Water spray) (3.52 days). The increase of shelf life in *Ascophyllum nodosum* treated plants over control may be due to that sea weed extract biostimulant induced photosynthesis that might have led to recombination of nutrients in flower that is used for remaining long days. The good quality flowers suppress ethylene and abscisic acid and prolong the shelf life and appearance of flowers. These findings corroborates the results reported by Hegde et al. (2016) in chrysanthemum, Povolny [12] in tomato.

3.6 Economic Analysis

Among the biostimulant treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest gross returns (₹ 76,93,200), net returns (₹ 59,82,204) and benefit cost ratio (3.50) (Table 3). Whereas T_9 - Control (Water spray) recorded lowest gross returns (₹ 50,13,200), net returns (₹ 33,92,200) and benefit cost ratio (2.09). It is evident from the data that, maximum gross return was recorded in T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) which might be due to higher number of flower stalks hectare $^{-1}$ as compared to others.

4. CONCLUSION

From the foregoing discussion it can be concluded that the application of *Ascophyllum nodosum* @ 5 ml L^{-1} at 30, 45 and 60 days after transplanting proved to be the best treatment for getting higher flowering, vase life and net returns. The key goals for commercial flower growing are to increase flower yield both qualitatively and quantitatively. Overall, the usage of biostimulants had a good impact on the parameters, which is significant for flower cultivation. As a result, biostimulants can be used sparingly in flower cultivation without harming the environment.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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